Self-Expanding Metal Stent (SEMS) insertion: Fluoroscopy versus pure endoscopic technique – A cost comparison

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Oesophageal cancer is a disease with significant morbidity and mortality, and in South Africa most patients present with advanced disease.[1] Self-expanding metal stents (SEMS) are now widely used in the palliation of oesophageal cancer, and in most institutions SEMS are deployed under fluoroscopic guidance. In our institution, we use an exclusive endoscopic deployment technique which is comparable to the traditional fluoroscopic technique in terms of safety and efficacy.[2-4] We undertook a study to compare the two techniques with respect to their time- and cost-effectiveness.

Method

This cross-sectional study compared two groups. One group from Greys Hospital in Pietermaritzburg underwent SEMS insertion under direct vision. The second group from Inkosi Albert Luthuli Central Hospital in Durban underwent SEMS deployment using the routine fluoroscopic technique. An average cost analysis was then performed. Following consultation with a statistician, the minimum number per group to achieve significance was calculated to be eleven. Twenty consecutive patients were therefore observed in each arm. A single observer documented the procedures at both institutions to standardise data collection. Each procedure was timed, and staff present, equipment required and drugs used were documented.

When evaluating the additional costs involved for stenting under fluoroscopy, use of the screening suite, fluoroscopy and contrast usage was assessed. As most state hospitals do not utilise an itemised billing service, average costing was estimated using protocols from Greys Hospital revenue department and private institutions. Two private radiology practices provided billing estimates for use in this study. Basic out-patient hospital charges, the use of endoscopy, hospital staff and items that were used as standard in both techniques were excluded from the costing analysis.

Radiation levels were indirectly assessed in the fluoroscopy arm at IALCH. The length of screening per procedure was documented and radiation exposure to the health-care worker was calculated using published data on dispersed radiation during screening.[4] These values were then evaluated against existing occupational health and safety guidelines.

Results

Both groups underwent SEMS insertion as outpatient procedures. This was performed under conscious sedation at both hospitals. The stent delivery system used at both hospitals was identical (partially- covered proximal-release Ultraflex stent manufactured by Boston Scientific). The drugs used in both techniques were Midazolam and Fentanyl. The time range for the pure endoscopic technique was 4–11 minutes (average of five minutes). SEMS insertion under fluoroscopy took between 5–24 minutes to perform (average of 17.5 minutes). The average time difference between the two techniques was 12.5 minutes (statistically significant $p < 0.01$).

Cost estimates were calculated using an average of three prices from the quotes obtained. The estimate for use of the screening suite was R2 056 per patient, fluoroscopy was R259 per 30 minute session, and contrast cost R270 per 300 ml. The range for screening time during fluoroscopic insertion was 1–4.5 minutes (mean of 3.5 minutes). The total amount of contrast used in the fluoroscopy arm was 278 ml. This equated to an average of 13.9 ml of contrast used per patient in this group. Using this information, the total additional cost in the fluoroscopic arm could then be calculated. The total additional cost per procedure done under fluoroscopy was therefore R2 099.

Radiation exposure during stent insertion was estimated at 0.3 micro-Sieverts (mSv) per minute. The average screening time per procedure was 3.5 minutes giving an average estimated radiation exposure to each health-care worker of 1.05 mSv per procedure. The fluoroscopic method was the more expensive technique at an additional R 2099 per patient. When evaluating the time taken for both procedures, the exclusive endoscopic technique was 12.5 minutes shorter than the conventional fluoroscopic technique. This was statistically significant. The radiation exposure to the health-care worker per fluoroscopic

Table 1: Cost estimates

Variable	Greys Revenue Quote	Private Practice 1 Quote	Private Practice 2 Quote	Average Cost Incurred
Screening Suite Cost (per event)	ZAR2002	ZAR2140	ZAR2025	ZAR2056
Charge on Fluoroscopy (per 30 minutes)	ZAR239	ZAR250	ZAR273	ZAR259
Contrast (per 300mls)	ZAR270	ZAR270	ZAR270	ZAR270

Table 2: Total additional cost associated with fluoroscopy

Variable	Average Unit Cost	Usage	Total Cost
Screening Suite	ZAR2056	per patient	ZAR2056
Fluoroscopy	ZAR259 / 30 mins	3.5 mins	ZAR30.22
Contrast	ZAR270 / 300 mls	13.9 mls	ZAR12.51
			ZAR2099

Table 3: Annual Saving in Perspective

	Per Procedure	Procedures per year	Annual Saving at Greys
Cost	ZAR2099	96	ZAR 201 504
Time	12.5 minutes	96	1200 minutes
Radiation exposure	1.05mSv	96	100.8mSv

procedure was estimated at 1.05 mSv.

The number of patients stented at Greys Hospital between 2007 and 2011 was 480. The average annual number of SEMS inserted at our institution over the past five years has been 96 patients. The annual savings from performing this technique at Greys can therefore be extrapolated to be R201 504, 1 200 minutes and 100.8 mSv of radiation exposure.

Conclusion

The exclusive endoscopic techniqe can be performed at any regional or district level hospital equipped with standard endoscopy. The annual saving of R201 504 could also be translated into the purchase of an additional seventy stent delivery systems, making SEMS available to more patients. The total annual time saved by performing the pure endoscopic procedure is 1 200 minutes. The annual radiation exposure estimated from the fluoroscopy group was 100.8 mSv. The exclusive endoscopic technique spares the health-care workers this exposure. Our data suggests that an exclusive endoscopic approach saves on time, time as money, and radiation and should be considered for all high volume units where the savings would be considerable.

Table 4: OSHA Guidelines

Body part	Radiation level
Whole body	20mSv
Skin, hands, feet, head	500mSv

References

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